Weekly Updates – Krishna Tarun Saikonda

In the same SUMO simulation, I meticulously designed three distinct collision scenarios utilizing the Enhanced Intelligent Driver Model (EIDM) car following model. Each scenario was carefully crafted to explore specific collision dynamics and their consequences. Furthermore, I ensured the capture of comprehensive data by storing the following output files in both XML and CSV formats:

Collision Outputs:
I've been tracking collision data, which includes information about when and where collisions occur in the simulation. This will be crucial for understanding the safety aspects of our scenarios.
Link: https://sumo.dlr.de/docs/Simulation/Output/Collisions.html

Trajectory Outputs:
The Amitran trajectories output contains information about the type, current speed, and acceleration of each vehicle.
Link: https://sumo.dlr.de/docs/Simulation/Output/AmitranOutput.html

Statistical Output:
I have collected statistical data that covers various attributes related to performance, vehicles, teleports, safety, persons, pedestrian teleports, vehicle trip statistics, pedestrian statistics, ride statistics, and transport statistics.
Link: https://sumo.dlr.de/docs/Simulation/Output/StatisticOutput.html

Lane Change Output:
The lanechange-output tracks all events where a vehicle changes laterally from one lane to another, defining the moment when the center line of the vehicle enters the new lane. It also contains the dominant reason for that change maneuver.
Link: https://sumo.dlr.de/docs/Simulation/Output/Lanechange.html

Simulation:

I have adjusted the simulation time to 0.1 using the command --step-length 0.1.the "step length" refers to the time increment used to update the simulation's state. A shorter step length, like 0.1 seconds with "--step-length 0.1," means more frequent updates, providing higher precision in modeling vehicle behavior and traffic dynamics but demanding more computational resources. A longer step length reduces computational demands but sacrifices some detail and accuracy. Selecting the right step length is essential for balancing simulation accuracy and computational efficiency based on research goals.

Simulation setup (All scenarios):

Parameter	Explanation
Step-length	Time interval for simulation steps, set to 0.10 seconds (10 cycles per second).
Collision.action	Action to take in case of a collision, set to "remove" (remove colliding vehicles).
Collision.stoptime	Time duration after which the simulation stops following a collision, set to 30 seconds.
Collision.check-junctions	Indicates whether to check for collisions at junctions, set to "True".
Begin	Start time of the simulation, set to 0.
End	End time of the simulation, set to 1000 units of time.
max-num-vehicles	Maximum number of vehicles in the simulation, set to 20.

Flow Attribute:

I've made significant modifications to vehicle insertion and positioning within the simulation. By utilizing specific flow attributes, I've gained greater control over how vehicles are introduced and positioned, as well as the speeds at which they enter the simulation. These adjustments have proven invaluable in conducting controlled experiments and have significantly enriched our research efforts.

Attribute	Value	Explanation
id	f_0	Identifier for the flow.
begin	0.00	Start time for the flow in simulation (seconds).
from	E0	Starting edge or location for the flow.
to	E2	Destination edge or location for the flow.
end	600.00	End time for the flow in simulation (seconds).
number	500	Number of vehicles to be generated in this flow.
departPos	random	Departure position type, set to random.
departLane	free	Departure lane type, set to free.
departPosLat	random_free	Lateral (sideways) departure position type, set to random_free.
arrivalPos	random	Arrival position type, set to random.
arrivalLane	random	Arrival lane type, set to random.

Scenario 1:

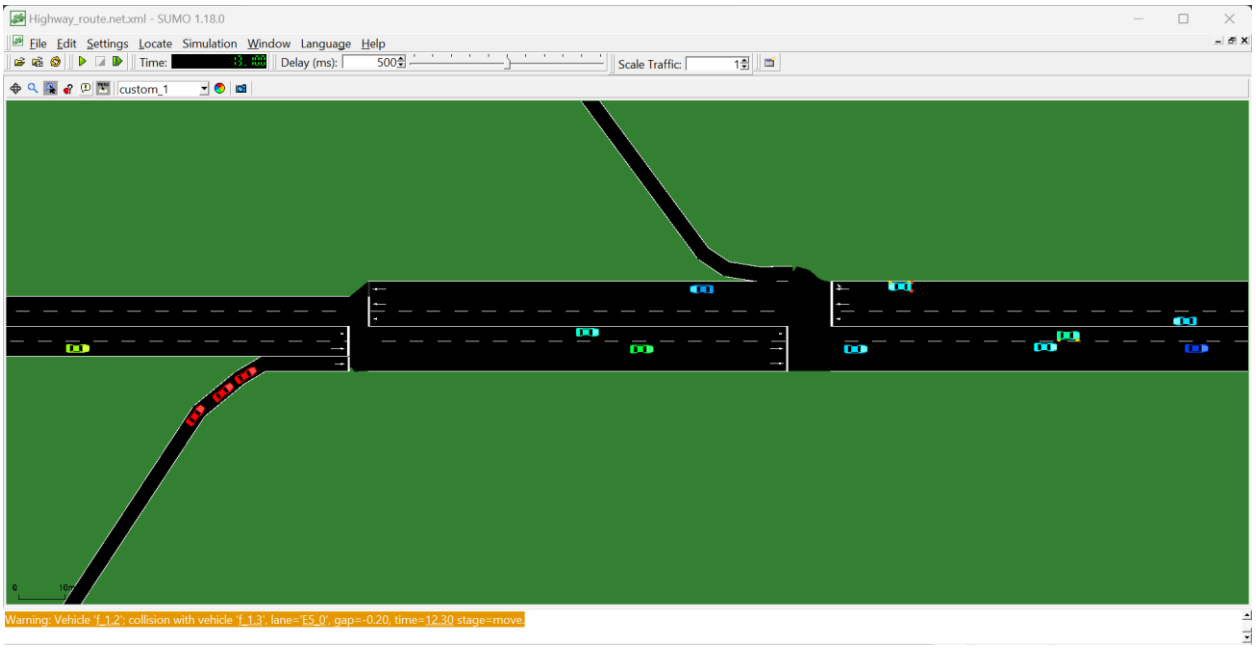
Studying Rear-End Collisions with EIDM Car Following Model in Highway Simulation

In this simulation scenario, we model a collision on a highway using the Enhanced Intelligent Driver Model (EIDM) car following model, illustrating the repercussions of reckless behavior. Within the highway environment, an ego vehicle, adhering to the EIDM model, engages in reckless actions such as sudden lane changes or aggressive acceleration. This reckless behavior ultimately leads to a collision with another vehicle, highlighting the importance of responsible driving practices. The collision disrupts traffic flow, causing nearby vehicles to adjust their speeds and lanes. This scenario emphasizes the significance of safe driving behavior on highways to prevent collisions and maintain overall road safety.

VType parameter:

Parameter	Value	Explanation
carFollowModel	EIDM	The car-following model used, which is "EIDM" (Enhanced Intelligent Driver Model).
sigma	0.5	A parameter in the EIDM car-following model representing noise in acceleration. It's set to 0.5.
tau	0.01	A parameter in the EIDM car-following model representing the driver's reaction time. It's set to 0.01.
collisionMinGapFactor	1.5	A factor used to calculate the minimum safe gap between vehicles to avoid collisions. It's set to 1.5 times the default value.
sigmagap	0.5	A parameter representing noise in the calculation of the minimum gap between vehicles. It's set to 0.5.
sigmaerror	0.3	A parameter representing noise in driver behavior, specifically in error. It's set to 0.3.
decel	26	The deceleration value (in m/s^2) used by vehicles in normal driving conditions. It's set to 26 m/s^2.
emergencyDecel	20	The deceleration value (in m/s^2) used by vehicles in emergency situations. It's set to 20 m/s^2.

Output:



Warning Output:

Parameter	Value	Explanation
Warning Type	Warning	Indicates the type of warning message.
Affected Vehicle	Vehicle 'f_1.2'	Specifies the vehicle that was affected by the collision.
Collision Vehicle	collision with vehicle 'f_1.3'	Identifies the vehicle with which the collision occurred.
Lane	'E5_0'	Indicates the lane in which the collision took place.
Gap	-0.20	Represents the gap between the vehicles at the time of the collision (negative value).
Time	12.30	Specifies the simulation time at which the collision occurred.
Stage	Move	Indicates the stage of the simulation when the collision happened.

Scenario 2:

Studying Lane Change Collisions with EIDM Car Following Model in Highway Simulation

In this particular scenario, I conducted an experiment within the simulation environment to intentionally create a collision. Specifically, I focused on the scenario where two vehicles collide while changing lanes. By adjusting certain parameters and conditions, I successfully constructed a situation where these two

vehicles came into contact during a lane change maneuver. This experiment allowed me to observe and study the dynamics of lane change collisions within the simulation, gaining valuable insights into how different factors influence such events.

VType parameter:

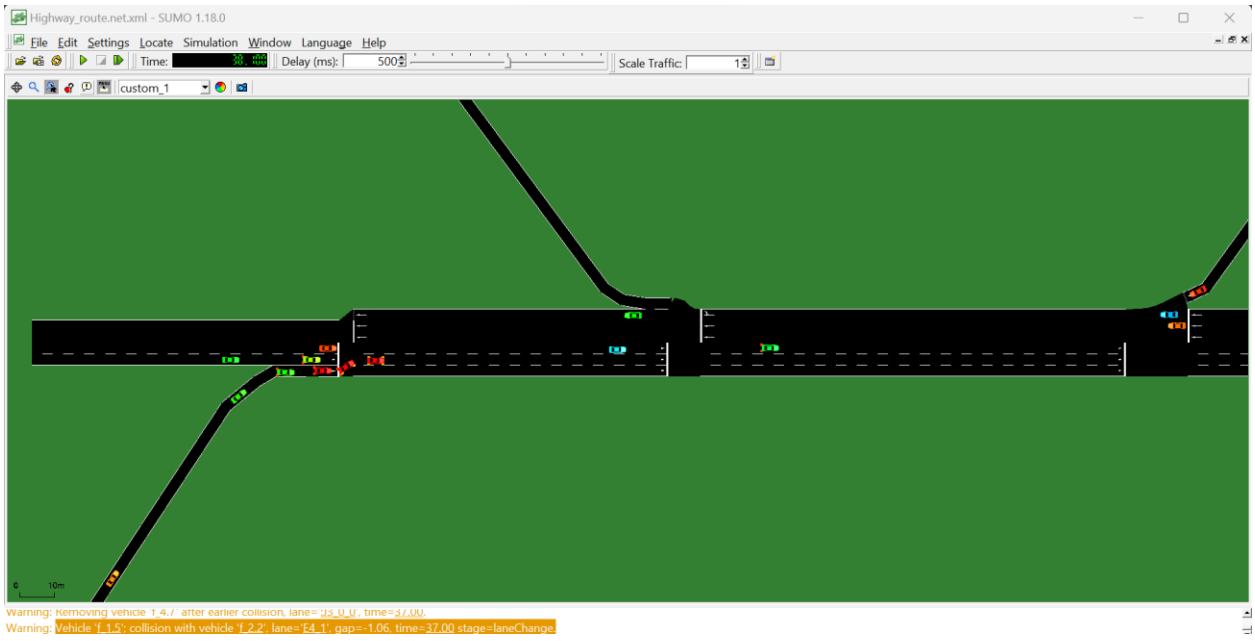
Parameter	Value	Explanation
laneChangeModel	LC2013	The lane change model used, which is "LC2013".
lcAccelLat	20	The lateral (sideways) acceleration allowed during a lane change, set to 20 m/s^2.
lcAssertive	1	A parameter indicating assertiveness in lane-changing behavior. It's set to 1.
lcPushy	1	A parameter indicating pushiness in lane-changing behavior. It's set to 1.
lcImpatience	1	A parameter indicating impatience in lane-changing behavior. It's set to 1.
lcSigma	0.7	A parameter representing noise in lane-changing decisions. It's set to 0.7.
lcSpeedGain	5	A parameter indicating the speed gain during a lane change maneuver. It's set to 5 m/s.
lcStrategic	0	A parameter indicating strategic lane-changing behavior. It's set to 0.
lcCooperative	0.2	A parameter indicating cooperativeness in lane-changing behavior. It's set to 0.2.
lcOvertakeRight	1	A parameter indicating a preference for overtaking on the right side during a lane change. It's set to 1.

Output:

Warning Output:

Parameter	Value	Explanation
Warning Type	Warning	Indicates the type of warning message.
Affected Vehicle	Vehicle 'f_1.5'	Specifies the vehicle that was affected by the collision.
Collision Vehicle	collision with vehicle 'f_2.2'	Identifies the vehicle with which the collision occurred.
Lane	'E4_1'	Indicates the lane in which the collision took place.
Gap	-1.06	Represents the gap between the vehicles at the time of the collision (negative value).
Time	37	Specifies the simulation time at which the collision occurred.

Parameter	Value	Explanation
Stage	LaneChange	Indicates the stage of the simulation when the collision happened.



Scenario 3:

Studying Junction Collisions with EIDM Car Following Model in Highway Simulation

In this scenario, I conducted an experiment within the simulation environment to deliberately engineer a collision between two vehicles at the junction. This collision was crafted by manipulating specific parameters related to the vehicles' behavior and junction conditions. By adjusting these parameters, I successfully constructed a situation in which these two vehicles collided at the junction. This experiment provided valuable insights into the factors and conditions that contribute to collisions at intersections, aiding in a deeper understanding of intersection collision dynamics within the simulation.

In the Net edit tool, when you connect or join two separate roads, it is typically considered as the creation of a junction or an intersection. This junction or intersection represents the point where the two roads meet and vehicles traveling on these roads may interact, change lanes, or turn onto other roads.

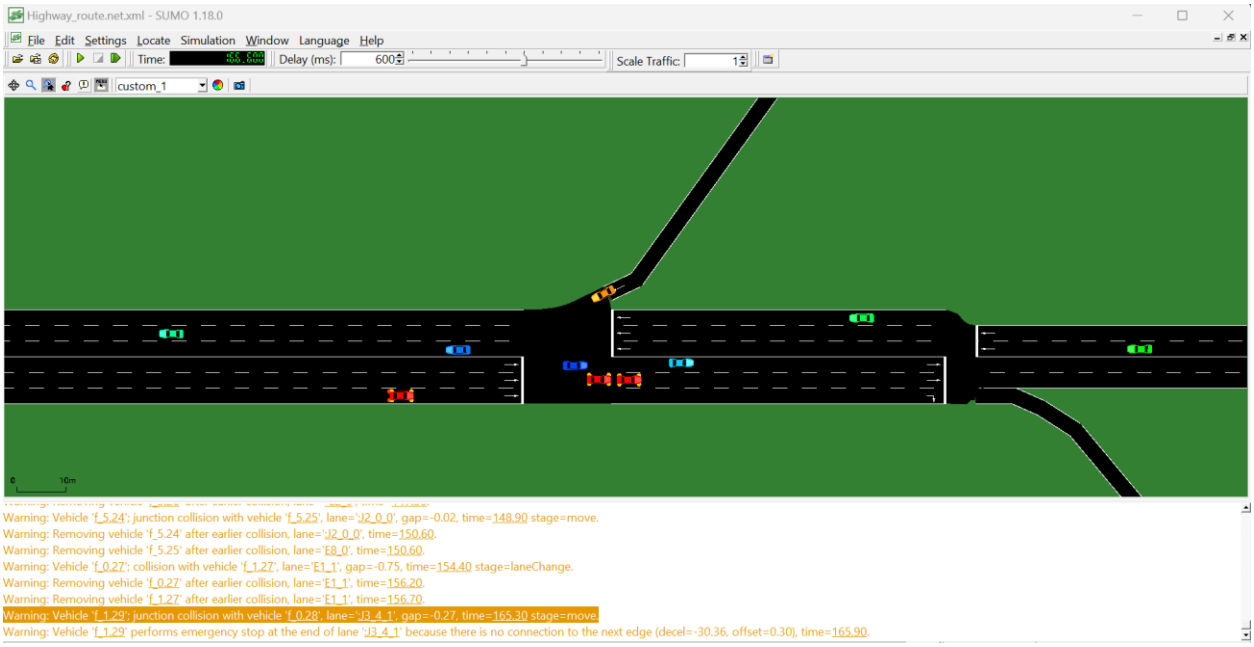
VType parameter:

Parameter	Value
impatience	0.50
jmSigmaMinor	1
jmIgnoreFoeSpeed	20
jmTimegapMinor	0.3
jmIgnoreJunctionFoeProb	1
jmIgnoreKeepClearTime	1

Output:

Warning Output:

Parameter	Value	Explanation
Warning Type	Warning	Indicates the type of warning message.
Affected Vehicle	Vehicle 'f_1.29'	Specifies the vehicle that was affected by the collision.
Collision Vehicle	collision with vehicle 'f_0.28'	Identifies the vehicle with which the collision occurred.
Lane	'J_3_4_1'	Indicates the Junction in which the collision took place.
Gap	-0.27	Represents the gap between the vehicles at the time of the collision (negative value).
Time	165.30	Specifies the simulation time at which the collision occurred.
Stage	Move	Indicates the stage of the simulation when the collision happened.



Position, Acceleration, and Velocity vs. Time:

I have collected data on vehicle positions, accelerations, and velocities over time for further analysis.I have done this using fcd output.The FCD (floating car data) export contains location and speed along with other information for every vehicle in the network at every time step. The output behaves somewhat like a super-accurate high-frequency GPS device for each vehicle.The graphs and plots generated from this data will provide insights into how these parameters change during the simulation and will help us make informed decisions.

Parameters:

Name	Type	Description
timestep	(simulation)	seconds
id	id	The id of the vehicle.
type	id	The name of the vehicle type.
speed	m/s	The speed of the vehicle.
angle	degree	The angle of the vehicle in navigational standard (0-360 degrees, going clockwise with 0 at the 12'o clock position).
x	m or longitude	The absolute X coordinate of the vehicle (center of front bumper). The value depends on the given geographic projection.
y	m or latitude	The absolute Y coordinate of the vehicle (center of front bumper). The value depends on the given geographic projection.

Name	Type	Description
z	m	The z value of the vehicle (center of front bumper). This value is only present if the network contains elevation data.
pos	m	The running position of the vehicle measured from the start of the current lane.
lane	id	The id of the current lane.
slope	degree	The slope of the vehicle in degrees (equals the slope of the road at the current position).
signals	bitset	The signal state information (blinkers, etc). Only present when option --fcd-output.signals is set.

time	id	x	y	angle	type	speed	pos	lane	slope	acceleration
0	f_0.0	-17.16	-4.8	90	DEFAULT_VEHTYPE	0	82.84	E0_0	0	0
0	f_1.0	-34.73	-10.65	52.12	DEFAULT_VEHTYPE	0	111.12	E5_0	0	0
0	f_2.0	-21.69	-1.6	90	DEFAULT_VEHTYPE	0	78.31	E0_1	0	0
0	f_3.0	362.87	4.8	270	DEFAULT_VEHTYPE	0	37.13	-E2_0	0	0
0	f_4.0	263.02	51.58	215.86	DEFAULT_VEHTYPE	0	60.91	E7_0	0	0
0	f_5.0	377.84	1.6	270	DEFAULT_VEHTYPE	0	22.16	-E2_1	0	0
0.1	f_0.0	-17.16	-4.8	90	DEFAULT_VEHTYPE	0.01	82.84	E0_0	0	0.15
0.1	f_1.0	-34.73	-10.65	52.12	DEFAULT_VEHTYPE	0.01	111.12	E5_0	0	0.15
0.1	f_2.0	-21.69	-1.6	90	DEFAULT_VEHTYPE	0.01	78.31	E0_1	0	0.15
0.1	f_3.0	362.87	4.8	270	DEFAULT_VEHTYPE	0.01	37.13	-E2_0	0	0.15
0.1	f_4.0	263.02	51.57	215.86	DEFAULT_VEHTYPE	0.01	60.91	E7_0	0	0.15
0.1	f_5.0	377.84	1.6	270	DEFAULT_VEHTYPE	0.01	22.16	-E2_1	0	0.15
0.2	f_0.0	-17.15	-4.8	90	DEFAULT_VEHTYPE	0.04	82.85	E0_0	0	0.28
0.2	f_1.0	-34.72	-10.65	52.13	DEFAULT_VEHTYPE	0.04	111.12	E5_0	0	0.28
0.2	f_2.0	-21.69	-1.6	90	DEFAULT_VEHTYPE	0.04	78.31	E0_1	0	0.28
0.2	f_3.0	362.87	4.8	270	DEFAULT_VEHTYPE	0.04	37.13	-E2_0	0	0.28
0.2	f_4.0	263.01	51.57	215.86	DEFAULT_VEHTYPE	0.04	60.91	E7_0	0	0.28
0.2	f_5.0	377.83	1.6	270	DEFAULT_VEHTYPE	0.04	22.17	-E2_1	0	0.28
0.3	f_0.0	-17.14	-4.8	90	DEFAULT_VEHTYPE	0.09	82.86	E0_0	0	0.49